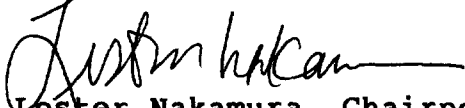


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LIST A B C D E

As Chairperson of Region 11, I was responsible for coordinating the activities of the Regional Planning Committee and the development of the final plan. I trust that the plan meets all the requirements of the FCC.

Sincerely,

A handwritten signature in dark ink, appearing to read "Lester Nakamura", with a long horizontal flourish extending to the right.

Lester Nakamura, Chairperson
Region 11
Information and Communication Services
Division

Attachment

PLAN CHECK LIST

- 1) Cover page - identifying the region
- 2) Chairperson - name, address, phone number, and signature
(See Section 6, Page 23 of plan and cover letter)
- 3) Committee Members - name, organizational affiliation, address, phone numbers
(See Section 6, Page 23 of plan)
- 4) Summary of major elements of the plan (See Table of Contents, page i and ii)
- 5) General description of how spectrum is allotted among users (See Section 3.0, page 5)
- 6) Explanation of how the requirements of all eligibles are considered and met (See Section 1.2, page 1)
- 7) ~~Explanation of how eligibles are prioritized in areas where not all eligible may receive licenses~~

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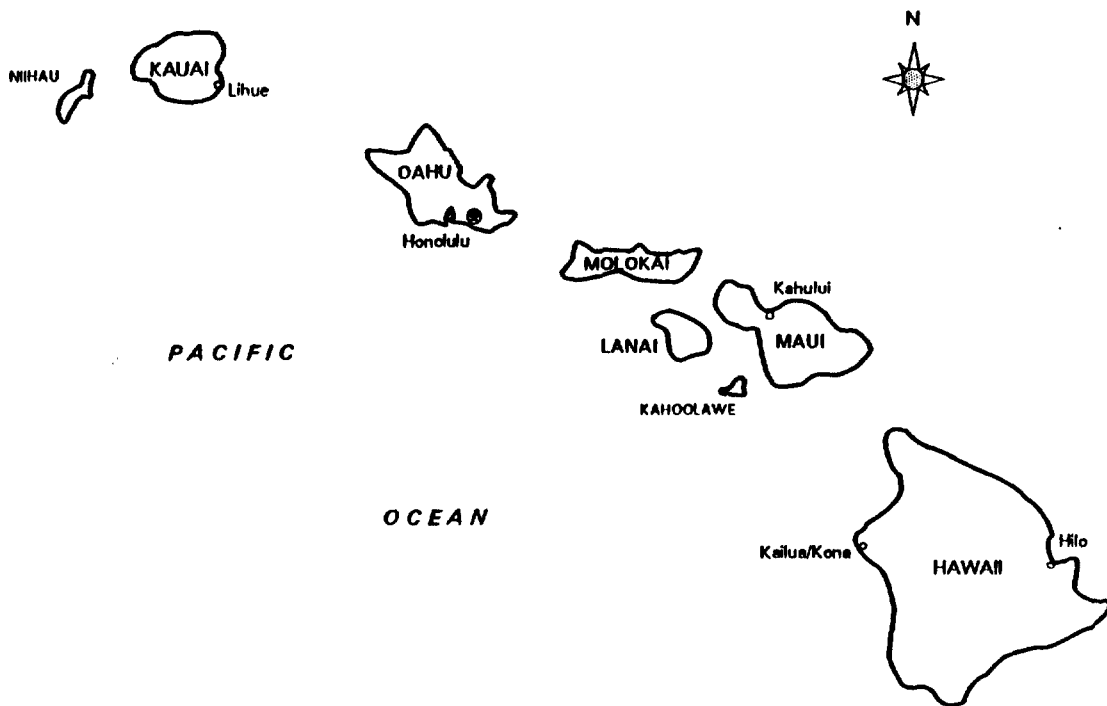
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JAN 25 1993

FCC - MAIL ROOM

STATE OF HAWAII

800 MHZ REGIONAL COMMUNICATIONS PLAN



REGION 11

JANUARY 1992

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1.0 SCOPE

1.1 INTRODUCTION

In December of 1983, the United States Congress directed the Federal Communications Commission (FCC) to establish a plan to ensure that the communications needs of state and local public safety authorities would be met. By their regular means of initiation, the FCC began the process of developing such a plan. Through their efforts, and the efforts of the National Public Safety Planning Advisory Committee (NPSPAC), the plan was begun.

The National Public Safety Planning Advisory Committee provided an opportunity for the public safety community and other interested members of the public to participate in an overall spectrum management approach by recommending policy guidelines, technical standards, and procedures to satisfy public safety needs for the foreseeable future. After consideration of NPSPAC's Final Report and comments filed in Docket No 87-112, a Report and Order was released by the FCC in December 1987, which established a structure for the National Plan that consists of guidelines for the development of regional plans.

The National Plan provides guidelines for the development of Regional plans. The particulars of this plan are found in FCC 87-359, which contains the required steps and contents for regional plan development. It is on this document that this plan for Region 11, State of Hawaii, is developed.

1.2 PURPOSE

Public safety communications has, for many years, been inadequate throughout the United States. This is as true for Hawaii as it is for any other state. Many, if not all, public safety radio users constantly contend with outside interference, noise, and overcrowding. It is with these problems in mind that this plan was developed.

This regional plan was developed with the objective of assuring all levels of public safety/public service agencies that radio communications in the near and distant future will not suffer from the problems of the past. The allocation of frequencies was done as equitably as possible. The goal was to supply a pool of frequencies for each county and a pool for state agency use with adequate reserve allocations for future needs in all areas, and a method to appeal initial allocations based on need.

The National Plan, as developed by NPSPAC, was followed very closely in all considerations for frequency allocation, re-use, turn back, regional interoperability, spectrum requirements, and adjacent region operations. This plan should provide the flexibility to accommodate growth and changes that are bound to occur in public safety and public service communications operations long into the future.

2.0 AUTHORITY

2.1 REGIONAL PLANNING COMMITTEE

The development of the Public-Safety Radio Communications Plan for Region 11, the State of Hawaii, has followed the requirements of the FCC's Report and Order as issued in the matter of General Docket 87-112.

In accordance with the FCC's Report and Order 87-112, the Associated Public-Safety Communications Officers Inc (APCO) recommended to the Commission the appointment of a "Convener" for Region 11. The Convener served as the coordinator for the assembly and formation of the planning committee.

Participants in the formation of the Regional Planning Committee represent interested parties from the Public Safety and Special Emergency Radio Services. A total of 15

3. The requirements for a regional planning committee were also presented and discussed at statewide organization meetings held in each County. At each presentation, there was an opportunity for persons to place themselves and/or their agency on the mailing list.
4. One statewide organizational meeting was held before the Chairperson was elected.
5. Personal interviews were held with the representatives of all major state and county agency radio users.
6. Committee membership was left open to any person or agency which may not have been notified or decided to join the committee later.
7. Vendor participation was encouraged, but vendors were not allowed a vote.

2.3 NATIONAL INTERRELATIONSHIP

The Regional Plan is in conformity with the National Plan. If there is a conflict between the two plans, the National Plan will govern. Due to the uniqueness of the State of Hawaii's geographical location, it has no adjacent regions requiring frequency coordination or regional plan concurrence. The State is located several thousand miles from the nearest major land mass. Further, the governmental structure has only two levels, which are State and County. There are no incorporated cities. Thus, the Regional 11 plan deals only with these two levels of government causing it to differ significantly from those approved for other areas of the country that may have the traditional three levels of government of City, County, and State.

It is permissible for a non-Federal government licensee to increase channel requirements to account for 2-10 percent increase in mobile units, dependent on the amount of Federal

3.0 SPECTRUM UTILIZATION

This portion of the plan provides a basis for proper spectrum utilization. Its purpose is to guide the local APCO frequency advisor and/or the Regional Review Committee in their task of evaluating the implementation of this plan within this Region.

3.1 REGION DEFINED

Region 11 is the State of Hawaii. This region is the result of definition by the Federal Communications Commission as a result of recommendations made in the National Public Safety Planning Advisory Committee (NPSPAC) plan as submitted and approved and contained in Docket 87-112. For purposes of this plan, the State shall be defined as all the lands and waters contained within the boundaries of the State of Hawaii.

3.2 REGION PROFILE (Demographic Information)

The purpose of this section is to provide the basis for the assignment of frequencies, and their re-use. Since the frequency allocation is based on geography, population, and operational needs throughout the state and counties, it is necessary to provide demographic information within this plan. This data is shown below.

3.2.1 State Of Hawaii Population And Expected Growth

The principal source for this data is the decennial population censuses conducted by the U. S. Bureau of the Census, the estimates developed by the Hawaii State Department of Business and Economic Development (DBED), the Hawaii Health Surveillance Program, the Hawaii Visitors Bureau, and the U.S. Immigration and Naturalization Service.

The 1990 resident and defacto population was 1,137,200. This includes members of the armed forces stationed in Hawaii and their local dependents, a group making up 10.4 percent of the resident total when last surveyed.

The 1993 population is estimated in excess of 1,161,371 and the projected population growth for the years 2000 and 2010 is estimated to be 1,285,100 and 1,435,500, respectively.

The third largest island, Oahu, with its highly urbanized area of Honolulu, has approximately 80 percent of the total population of the State, and the 1993 population estimate approaches 861,000. The balance of the State population is spread among the more rural islands of Kauai, Maui, Lanai, Molokai, and Hawaii. (See population data in Appendix D)

3.2.2 Geographical Description

The State of Hawaii is located in the Pacific Ocean several thousand miles from any major land mass. It is approximately 2,650 nautical miles west of the continental 48 states. It was formed from volcanic activity and the existing islands are the summits of a great volcanic mountain range that stretches nearly 2,000 miles across the floor of the Pacific Ocean. The topography of the state contains small rolling plains to extremely rugged mountainous terrain with water falls, green canyons, and vegetation ranging from sparse to extremely dense. (Refer to a map of the State of Hawaii in Appendix C)

The total land mass in the State is 6,423.4 square miles, an area that continues to increase as new land is formed by volcanic activity and coral accretions. The major islands are: Kauai, Oahu, Maui, Molokai, Lanai, and Hawaii. The Island of Niihau is privately owned but is administered by the County of Kauai. The population per square mile is somewhat sparse, which generally indicates that the concentration of radio users for public safety activities is in the major urban area of Honolulu.

The largest island is Hawaii. It is nearly twice as large as the other islands combined with a total of 4,028.4 square miles. It has the state's highest mountain, Mauna Kea, at 13,796 feet above sea level. The Island of Hawaii has the state's only active volcanoes of Mauna Loa and Kilauea, both located within the Hawaii Volcanoes National Park.

The second largest island is Maui, with 727.3 square miles. Maui is the site of Haleakala and Puu Kukui, two dormant volcanoes, which are separated by a seven mile isthmus. Most of the island's residents dwell along the west coast and on the northern shore of the isthmus in the communities of Wailuku and Kahului.

The third largest island of Oahu, with over 600 square miles, is the best known and is traditionally the most popular place for visitors. It is the seat of state government with the capitol at Honolulu. It is also the site of Waikiki Beach, Diamond Head, and Pearl Harbor.

Honolulu, with its commerce, industry, and its famous resort beach, is the heart of both the island and the state. Commercial, governmental, and military are the primary economic force. The military installations employ thousands, and the Federal expenditure ranks first as a source of the island's and the state's revenue with tourism ranking second. (See state economic projections in Appendix D)

Geologically the oldest and the fourth largest is the island of Kauai with 552.3 square miles. The wettest spot on earth is here and the island is noted for its lush foliage. Kauai's nearest neighbor is the 70.2 square mile Island of Niihau, which is privately owned and populated mainly by pureblood Hawaiians.

The fifth and sixth largest islands are the sparsely populated islands of Molokai and Lanai, respectively. Both these islands are administered by the County of Maui. Molokai covers 260.0 square miles and 140.5 square miles make up the island of Lanai. Both are mostly rural and untouched by development, with the exception of a resort area on the western end of Molokai and the south side of Lanai.

From the standpoint of state agency radio users, the distance and separation between the islands presents some problems in coverage for statewide radio systems. This concern has been taken into consideration in the allocation plan.

3.3 USAGE GUIDELINES

All systems operating within the Region having five or more channels will be required to be trunked. Those systems having four or less channels may be conventional or trunked.

The FCC, in its Report and Order states, "Exceptions will be permitted only when a substantial showing is made that alternative technology would be at least as efficient as trunking or that trunking would not meet operational requirements. Exceptions will not be granted routinely, however, and strong evidence showing why trunking is unacceptable must be presented in support of any request for exception."

Systems of four or less channels operating in the conventional mode that do not meet FCC loading standards will be required to share the frequencies on a non-exclusive basis.

The first level of communications coverage will be at the state level. Its impact will be reviewed by the Committee. All public safety agencies operating statewide will submit their communications plans for impact approval if they utilize communications systems within the Region, and those portions of such systems must be compatible with the Regional Plan.

State agencies have a need for radio operations on all the islands. However, because the islands are not contiguous and are widely separated, a single statewide trunking system for State operations is not envisioned. A combination of state trunked and conventional channels may be implemented on each island. It is anticipated that where statewide interconnect communications is deemed necessary between islands for state agencies, designated conventional channels will be utilized.

However, where technically and operationally feasible, the agencies of the State of

The next level of communication coverage will be county, which, in most cases includes a single island, such as the islands of Kauai (County of Kauai), Hawaii (County of Hawaii), and Oahu (City and County of Honolulu). The islands of Maui, Molokai, and Lanai are all administered by the County of Maui and communications coverage is required for each of the three islands. County systems shall be designed to provide countywide communication coverage.

However, communication coverage beyond the bounds of a county jurisdictional area on that county's system will not be permitted unless it is critical to the protection of life and property. Communications between and among the county users will occur on one of the statewide mutual aid or other channels established for interoperability. Where 800 MHz trunked radio technology is utilized, the system design must include as many county public safety and public service radio users as can be managed technically.

The county agency(ies), depending upon system loading and the need for multiple systems within an area, must provide intercommunications between area-wide systems.

3.4 TECHNICAL DESIGN REQUIREMENTS FOR LICENSING

3.4.1 Definition of Coverage Area or Area of Jurisdiction

The coverage area shall be that area for which a system is intended to cover with a received signal strength of 40 dBu or greater. This area shall normally represent the boundaries of each county which is applying for license but may include separate localized, low elevation systems having limited coverage.

3.4.2 System Coverage Limitations

Radio coverage in each of the counties (islands) is heavily affected by mountainous terrain. In order to obtain adequate wide area coverage, it is necessary to utilize numerous high level or elevated sites within each county. Over-the-water paths from elevated sites are known to exist between the islands. As such, and to the extent possible, countywide system coverage shall be limited to the coverage area defined as listed above plus no more than twenty-five (25) miles in all directions extending outward over the ocean waters from the boundaries of each county. This limitation shall assure maximum frequency reuse between the islands. Localized, low elevation systems shall be limited to a coverage area of not more than three (3) miles in all directions from the boundaries of the legally defined area of service.

The only exception to this rule shall be those applicants that may offer service or system use to areas outside of their jurisdictional boundaries, such as the County of Maui which administers the islands of Lanai and Molokai. In these situations, the applicant shall provide a proposal of said service to the local APCO frequency advisor, who may request Regional Review Committee consideration, for approval.

The system may use both omni-directional and directional antennas, but in no case, shall the effective radiated power (ERP) be more than necessary to provide the required coverage of the operational area. Localized and low elevation systems operating within a larger county area shall utilize either minimum power and antennas or antenna/tower relationship techniques to achieve only the necessary coverage within their operational area.

3.4.3 Determination Of Coverage

There are four variables used in determining the area of coverage of a proposed system. These variables are: (1) the required strength of the received signal, (2) antenna height above average terrain (HAAT), (3) the effective radiated power (ERP) of the system, and (4) the type of environment.

Received Signal Strength

For purposes of this plan, "received signal strength" shall be the determining factor which defines the actual boundary of a system. The minimum signal level which marks the outer boundary of a system shall be 40 dBu.

Antenna Height

For purposes of this plan, "antenna height" shall be the height of the antenna above the average terrain surrounding the tower site.

Effective Radiated Power (ERP)

The ERP is the transmitter output power times the net gain of the antenna system. The actual formula is $ERP(w) = Power(w) \times \text{antilog}(\text{net gain in dB divided by } 10)$.

Environment Type

OKUMURA/HATA METHOD - The Okumura method uses four different classifications to describe the average terrain around a transmitter site or area. These four classifications are:

1. **URBAN:** An area that is built-up, city-crowded with large buildings or closely interspersed houses and thickly-grown trees. This would include the downtown area of a major city.
2. **SUBURBAN:** A city of highways with scattered trees, houses, and buildings. This would include the downtown area of a small city.
3. **QUASI-OPEN:** An area between suburban and open areas. This includes areas outside of city limits that have few buildings and houses.
4. **OPEN:** An area where there are no obstacles such as tall trees or buildings in the propagation path or a plot of land that is cleared of anything for 300 to 400 meters ahead. This would include farm land, open fields, etc.

In all counties, regardless of size, a maximum coverage radius of twenty-five (25) miles extending from the coastline for countywide systems shall be allowed, provided adequate measures have been taken to ensure that interference of existing co-channel and adjacent

part 90.309(a)(4) of the Rules and Regulations, some additional guidance for these calculations.

3.4.4 Annexations and Other Expansions

The State of Hawaii has only two levels of government, state and county. There are no incorporated cities as is common on the mainland. All communities, towns, or cities (such as Honolulu) located within each county are part of that county political jurisdiction, which is generally confined to a single island. Thus, annexations are not an issue in the State of Hawaii.

However, it is understood that a non-countywide, localized system may have to be expanded and its range increased if the size of the service area is enlarged. This is a modification and may be permitted. The increased range of the system will have to be determined at the time of modification to assure non-interference with any other existing system. Where interference is likely, the use of alternate methods of expansion, such as remote receiving systems, may be necessary.

Should the expansion effectively take in all or most of a county, the allocation for the localized system may be given, but not required, to the county for inclusion of the countywide system.

In any case where more spectrum is not available from the initial allocation, the rules for expansion of initial allocation, as contained in this plan, shall apply.

3.4.5 Coverage Area Description

All applicants shall provide with their applications, a map showing the jurisdictional boundaries to be covered by the system and the calculated system coverage. This map shall display the location of the system transmitter(s), including control stations. It is recommended that a U.S. Geological Survey (USGS) quad topographical map be used for this purpose. If not available, a high-quality, locally-produced map or a highway map may be substituted. Regardless of the type map used, the name of the applicant and the scale of the map shall be displayed on the map.

The Regional Planning Committee shall have the freedom to consider below 800 MHz public safety bands in developing their regional plans, but the licensing of channels in these bands would continue to be conducted through existing frequency coordination procedures.

It is recommended that any jurisdiction wishing to "hand down" frequencies to another agency or jurisdiction submit the proper coordination and application forms with the document of release.

3.4.7 Unused Spectrum

Because all of the frequency spectrum is not needed at this time, unassigned channel pairs will be returned to a reserve pool. These channels may be used for conflict with adjacent counties or may simply remain within this Region until needed. This does not imply that these frequencies are unavailable; only that before they can be utilized within the Region, they must be coordinated via the regular APCO coordination process and within the guidelines set forth in this plan. Where possible, the channels designated for a jurisdiction in this plan shall be used.

3.4.8 Adjacent Region Coordination

Coordination with adjacent regions are not required due to the remoteness of the State of Hawaii from any other land mass. However, all national, state, and county level mutual channels will be coordinated for use throughout the state. The use of these channels will be in keeping with the approved guidelines.

Any user found to be operating in any manner other than the approved method shall be considered to be operating improperly and subject to the existing Federal Communications Commission rules for willful interference with the communications of other users.

3.5 INITIAL SPECTRUM ALLOCATION

3.5.1 Frequency Sorting Methodology

The initial spectrum allocation for the Region was determined by a computerized frequency sorting process performed by APCO. The purpose of the computer program, which assigns frequencies to specific eligibles and to pools for future assignments, is two-fold:

- 1. The assignments must result in a high degree of spectrum efficiency.**
- 2. The assignments must result in a low probability of co-channel and adjacent channel interference.**

Since the desired output is a geographic sorting of frequencies, a method of defining geography must be part of the input. A list of the number of channels to be assigned in each geographic area is also required, along with the name of the eligibles or pool.

Acceptable interference probabilities are determined for the Region. Frequency assignments are then made using a computer program that satisfies the goals of spectrum efficiency and interference protection. The following narrative describes the factors and process used by the computer program.

3.5.2 Geographic Area

For the purpose of this frequency sort, a geographic area is defined as one or more circles of equal radius. To the degree practical, the circle(s) include the entire area of the eligible's geopolitical boundary, which in the case of countywide systems, includes the entire island making up that county.

Thus, the procedure is to gather maps of sufficient detail, outline the areas to be defined, determine the coordinates and radius of the circle(s) that define(s) each area, and tabulate the data.

In any case, the effective radiated power (ERP) shall not exceed that necessary to provide the required coverage on a non-interfering basis to other counties (islands) and/or adjacent systems.

The environment of each system is defined according to the Okumura/HATA method of classification.

3.5.4 Transmitter Combining

The computer program is designed to provide a minimum frequency separation between any two channels assigned to the same eligible at the same site. This separation is provided in order to enable more efficient combining of multiple transmitters to a single antenna. These separated blocks of frequencies also have a maximum size.

If the eligible has more frequencies than the maximum size of the combining block, then a second compatible block is created, and so on. Each of these parameters is adjustable in the program on a global basis. The default parameters chosen are 0.25 MHz minimum spacing and five channel blocks.

3.5.5 Special Considerations

There are licensees in the 806-821/852-866 MHz spectrum who plan to expand existing systems into the 821-824/866-869 MHz bands. Some of the existing radio units are unable to operate on 12.5 KHZ separated carrier frequencies. The result is that these radios can only operate on "even" FCC numbered channels in the 821-824/866-869 MHz band. The computer program is able to take this into account when making assignments.

3.5.6 Protection Ratios

There are two interference protection ratios built into the computer program. One is for the co-channel case; the other is for the adjacent channel case. The ratios provide 35 dB desired/undesired signal ratio for co-channel assignments, and 15 dB desired/undesired ratio for the adjacent channel case. These ratios provide an acceptable probability of interference for public safety services.

4.0 COMMUNICATIONS REQUIREMENTS

4.1 COMMON CHANNEL IMPLEMENTATION

The implementation of the International Common Channels must follow the guidelines as set forth by the Federal Communications Commission by the approval of the National Plan. These five common channels are accessible by all levels of government and shall be used in accordance with the provisions of the National Plan. All mobile and portable equipment must be equipped to operate in the "talk around mode" when required on the International Channels.

The International Calling Channel operating on 821/866.0125 MHz shall be implemented as a full mobile relay system. Wide area coverage transmitters will be installed where applicable within a system. Large system users, such as a county, with five or more 800 MHz channels shall be required to monitor this channel at all times. The area of coverage for this channel shall be equal to the area covered by the licensed system. This may or may not require the use of remote receivers within the area to meet this requirement.

The four International Tactical Channels will be assigned statewide, for use as needed by all eligible licensees. These channels are to be used in accordance with the National

Participants in the interoperable channels include federal, state, and local disaster management agencies. Police, fire, and providers of basic and advanced life support services will be the primary using agencies. If radio channels are available, other services providers in the Public Safety Radio Service and the Special Emergency Radio Service may also participate to the extent required to ensure the safety of the public. These include the state and county public service agencies and other special service organizations not normally involved in day-to-day public safety operations.

4.1.3 Operation Procedures

On all Common Channels, plain English will be used at all times, and the use of unfamiliar terms, phrases, or codes will not be permitted.

4.1.4 International Calling Channel (ICALL):

The ICALL channel shall be used to establish contact with other users in a particular Region that can render assistance at an incident. This channel shall not be utilized as an ongoing working channel once contact has been established between agencies. An agreed-upon tactical or mutual-aid channel shall be used for continued communications.

4.1.5 International Tactical Channels (ITAC-1 through ITAC-4)

These frequencies are reserved for use by those agencies involved in inter-agency communications. Incidents requiring multi-agency participation will utilize these frequencies as directed by the control agency assuring responsibility for an incident or area of concern. These frequencies may be subdivided according to function in an incident or by geographical location in response to an incident. It is recommended that the following assignments for ITAC-1 through ITAC-4 be used when possible.

ITAC-1.....Law Enforcement
ITAC-2Fire Services
ITAC-3Emergency Medical Services

NETWORK OPERATING METHODS

Communications systems on ITAC-1 through ITAC-4 will be implemented by agencies who volunteer on a distributed coordinated basis. Every primary geographic section of

A requesting applicant for radio communications in the 800 MHz Public Safety Radio Services in the Region will be required to conform to the FCC loading criteria for its proposed system. The provisions of this regional plan must be used as a guide for establishing any new systems.

Strict adherence to the rules for limiting the area of coverage to the boundaries of the applicant agency's jurisdiction must be observed. Overlap or extended coverage must be minimized, even where systems utilizing 800 MHz trunked radio systems are proposing to intermix systems for cooperative and/or mutual-aid purposes.

Where antenna locations are utilized on elevated sites, such as mountain tops, transmitter outputs and antenna gain and/or patterns must be employed to produce only the FPP and